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July 28, 2010

Patent No.: 6,767,433 B2
Applicant : Robert E. Foster, et al.
Issued : July 27, 2004
For : **SYSTEM AND METHOD FOR SOLAR DISTILLATION**
Attorney Docket Number: 257/253

Re: Request for Certificate of Correction

Consideration has been given your request for the issuance of a certificate of correction for the above-identified patent under the provisions of Rule 1.323.

Respecting the alleged errors at Item (56) References Cited. The addition of the reference 6,418,417 B1 7/2002 Corby et al. ....705/35 is not listed in the PTO-892 provided in the Request filed July 8, 2010. Also, there is no 1449 nor a copy of the publiscation to ROBERT FOSTER AND MIKE CORMIER, "Solar Still Construction and Operation, "El Paso Solar Energy Association (El Paso, Texas) (Summer 1999). The above reference and publication have not been considered and request to include them are disapproved.

In view of the foregoing, your request for certificate of correction is hereby denied. A certificate of correction will be issued to correct the remaining errors in your request.

Further correspondence concerning this matter should be filed and directed to Decisions and Certificates of Correction Branch.

Decisions and Certificates of Correction
Antonio Johnson
(571)272-0483

WOLFF LAW OFFICE, PLLC
P.O. BOX 9855
CHAPEL HILL NC 27515-9855

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Robert E. Foster et al. | Patent No.: **6,767,433**

Application No: **09/845,359** | Group Art Unit: 1764

Filed: May 1, 2001 | Examiner: Virginia Monoharan

For: SYSTEM AND METHODS FOR SOLAR DISTILLATION

RESPONSE TO LETTER REGARDING A REQUEST FOR CERTIFICATE OF CORRECTION UNDER 37 CFR 1.322 and RENEWED REQUEST FOR CERTIFICATE OF CORRECTION

Attention: Decisions and Certificates of Correction Branch
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Dear Examiner Johnson:

In response to the letter dated July 28, 2010 regarding a Request for Certificate of Correction (copy attached herewith), Applicant submits the following remarks.

Applicants hereby respectfully request to have the Examiner reconsider the Applicants' request to include one reference omitted from the "References Cited" section of the first page of the issued ribbon copy.

This one omitted reference was included in Applicants' Information Disclosure Statement, dated July 10, 2001 as evidenced by the USPTO date stamped Filing Receipt submitted herewith. This IDS included one publication reference. Although there are no Examiner initials beside the reference to indicate that the Examiner considered the document, although Applicants believe that the document was submitted at such an early stage in the prosecution that the Examiner had ample opportunity to consider the reference and must have considered it. Further, the undersigned vaguely recalls discussing or referring the Examiner to this reference, therefore, Applicants respectfully request that a Certificate of Correction be issued in U.S. Patent No. 6,767,433 to include this reference.

Further, the undersigned notes for the attention of the USPTO that on July 31, 2001, the undersigned filed additional prosecution material which are included in the Public PAIR file wrapper for the above-referenced patent but some of the documents cannot be view due to an error message of "Error 500:". Therefore, it may be possible that during this time, the copy of the formal documents filed along with the corresponding reference submitted and received on July 10, 2001 may have been misplaced or a technical error occurred by the USPTO.

Therefore, Applicants submit herewith, copies of the aforementioned correspondence that show the listing of reference and an entire copy of the published article that was omitted from the cover page of the issued patent. This document does not appear to be correctly included in the electronic file history of the patent application. This error was incurred through the fault of the USPTO, and thus no fee is due.

Further, Applicant has included herewith a Certificate of Correction showing the needed change.

Respectfully submitted,

Kevin Alan Wolff, Reg. No.: 42,233
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P.O. Box 9855
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Date: March 7, 2011

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : US 6,767,433

APPLICATION NO.: 09/845,359

ISSUE DATE : July 27, 2004

INVENTOR(S) : Robert E. Foster, Michael J. Cormier, Gregory R. Vogel

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title Page, item (56), column 1, under the header U.S. PATENT DOCUMENTS: insert new header --OTHER PUBLICATIONS-- --ROBERT FOSTER AND MIKE CORMIER, "Solar Still Construction and Operation," El Paso Solar Energy Association (El Paso, Texas), (Summer 1999). -- after "6,440,275 B1* 8/2002 Domen ..... 202/234"

MAILING ADDRESS OF SENDER (Please do not use customer number below):

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Chapel Hill, NC 27515-9855

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FILING RECEIPT

PLEASE DATE STAMP AND RETURN

In re Application of: Robert E. Foster, et al.

Application No: **09/845,259** Group Art Unit: TBD

Filed: May 1, 2001 Examiner: TBD

For: SYSTEM AND METHOD FOR SOLAR DISTILLATION

PAPERS INCLUDED:

1. Information Disclosure Statement with attachment
2. Copy of Article by Robert Foster and Mike Cormier

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PATENT & TRADEMARK OFFICE

Date: July 10, 2001

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PATENT APPLICATION
DOCKET NO.: SolAqua-US0001 (US-09/845,259)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Robert E. Foster, et al.

Application No: **09/845,259** Group Art Unit: TBD

Filed: May 1, 2001 Examiner: TBD

For: SYSTEM AND METHOD FOR SOLAR DISTILLATION

INFORMATION DISCLOSURE STATEMENT

Commissioner of Patents
Washington, D.C. 20231

Sir:

In accordance with 37 C.F.R. §§ 1.97 and 1.98, Applicants hereby discloses to the Office the items identified in this Information Disclosure Statement (IDS). The items are listed on the attached form PTO-1449.

The items identified in this IDS may or may not be "material" pursuant to 37 C.F.R. § 1.56. The submission thereof by Applicants is not to be construed as an admission that any such patent, publication, or other information referred to therein is material or considered to be material (see 37 C.F.R. § 1.97(h)) or qualifies as "prior art" under 37 C.F.R. § 102 with respect to the invention, unless specifically designated by the Applicants as such.

This IDS is believed to be properly filed under 37 C.F.R. § 1.97 (b)(1) because this IDS is filed before a first office action. Thus, Applicants believes no fee is required. However, if the Office disagrees, then it is requested that the Office consider this IDS as filed under 37 C.F.R. §

1.97(c) and notify the undersigned of the fee being due under 37 C.F.R. § 1.17(p).

Respectfully submitted,

Kevin Alan Wolff
Reg. No. 42,233

Wolff Law Offices
600 F Street, N.W.
Washington, D.C. 20004
Phone/Fax: (202) 347-4049

Date: July 10, 2001

Please type a plus sign (+) inside this box [+]

PTO/SB/08B (10-96)
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Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449B/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	09/845,359
Filing Date	05/01/2001
First Named Inventor	Robert E. Foster
Group Art Unit	
Examiner Name	
Attorney Docket Number	SolAqua -US0001

OTHER PRIOR ART -- NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		ROBERT FOSTER AND MIKE CORMIER, "Solar Still Construction and Operation," El Paso Solar Energy Association (El Paso, Texas). (Summer 1999).	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] Unique citation designation number. [2] Applicant is to place a check mark here if English language Translation is attached.

Burden Hour Statement: This form is estimated to take 2.0 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231.

The Answer Comes Up Eve[ry] Morning

EL PASO SOLAR ENERGY ASSOCIATION

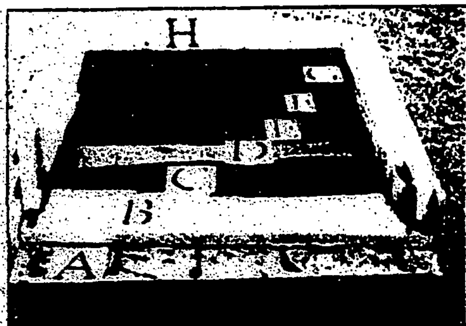
P.O. Box 26384 El Paso, Texas 79926 USA

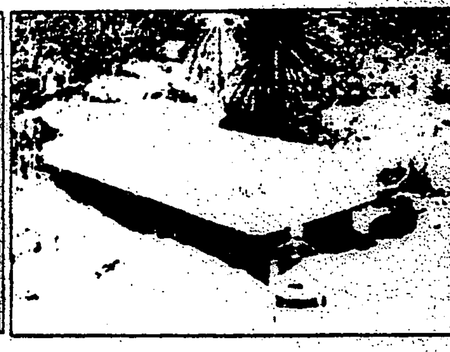
www.epsea.org

Summer 1999

SOLAR STILL CONSTRUCTION AND OPERATION MANUAL©

By Robert Foster and Mike Cormier





Research Sponsored by
Texas General Services Commission's State Energy Conservation Office
Southwest Technology Development Institute at New Mexico State University

Introduction

Clean drinking water remains one of the most important international health issues of today, and solar energy offers important a[…] effective solutions in meeting potable water needs worldwide. For about half of all Americans, tap water comes from rivers and lakes. F[…] another 35%, it comes from underground aquifers, while about 15% rely on private wells which are not regulated (Uehling, 1996).. Som[…] Americans, such as those who live in the various unincorporated colonias along the Mexican border, access to clean drinking water is a b[…] problem. However, no matter where you get your water, any source can become tainted, even if you buy your water at the store, ther[…] no guarantee that it is safe.

The El Paso Solar Energy Association, working with the State of Texas is using solar energy to distill water to provide safe drinking wat[…] In many places worldwide, including in the United States along the Mexican border, drinking water supplies are contaminated by m[…] crobes, parasites, high salt concentrations, and industrial pollutants. Single-basin solar stills are easy to build, inexpensive, have […] moving parts to break, and are extremely effective in providing clean drinking water from a high dissolved salt content water and also […] eliminating dangerous bacteria such as cholera and E. coli. Single-basin solar stills can use commonly available materials based on prov[…] designs. Average water production in good solar insolation regions (>6 kWh/m^2) for a typical still (2.6 m^2) can be more than 3 gallons p[…] day.

New Still Owner in El Paso learning about Proper Still Operation

The State of Texas Sustainable Energy Development Council (no[…] the State Energy Conservation Organization - SECO) saw the o[…] portunity to apply solar energy technologies to address water qua[…] ity problems along the border. The State of Texas awarded the […] Paso Solar Energy Association a small grant in late 1994 to 19[…] from oil overcharge funds to develop and introduce solar still tec[…] nologies as a demonstration project for application in colonias alo[…] the Mexican border in Texas.

In 1998, EPSEA partnered with Southwest Technologu Develo[…] ment Institute (SWTDI) at New Mexico State University to intr[…] duce solar stills in Dona Ana County, N.M. In addition, SWTDI […] conducting extensive testing of the stills to determine their effe[…] tiveness in eliminating a variety of bacteria, heavy metals, pest[…] cides, flouride and other contaminants commonly found along th[…] U.S. - Mexico border.

Colonias are unorganized, unincorporated subdivisions along th[…] U.S.-Mexican border (along the Rio Grande) in which there is ofte[…] substandard housing, inadequate roads and drainage, and substan[…] dard or no water and sewer facilities. Dwellings in colonias rang[…] from normal housing to conglomerations of mortar, brick, concrete[…] plywood, and other makeshift structures.

El Paso County has about 250 colonias with nearly 90,000 residents. Only a few of these colonias have water and sewage systems and even less have any sewage systems. The City of El Paso stopped extending water lines outside the city limits in 1979.

Residents of these colonias may have shallow brackish water wells, they may haul water from family or friends living in El Paso or Ciudad Juárez, they may purchase drinking water from area stores, or they may have water delivered by a local water delivery company.

The shallow water wells that exist are typically high in minerals and contain non-potable drinking water. Water is often stored in large barrels that sometimes previously held toxic chemicals. Colonia residents use septic tanks, pit privies, and cesspools for sewage disposal, although many septic tanks do not function properly and easily contaminate groundwater because of the high water tables in the valley.

EPSEA enlisted the assistance of longtime solar still pioneer Horace McCracken to learn from his 40 years of experience with solar distillation. Mr. McCracken began his career in solar distillation at the University of California Sea Water Conversion Laboratory in 1958 and has tested over 400 different solar still designs since then. In 1964, he began using silicone sealant to form a waterproof membrane in the still. Based on EPSEA's own research and after consulting with Horace McCracken, the final design for the EPSEA still was formulated. A primary goal of the design was ease of replicability, using "off-the-shelf" materials. EPSEA's own design has positively influenced McCracken to modify the design of his own stills, which he claims have improved in performance by 10% after adopting EPSEA changes.

ACKNOWLEDGMENTS

The authors would particularly like to thank Jan Pulaski, formerly of the Texas State Energy Conservation Office and Judith Carroll, formerly of the Texas Department of Commerce for their vision in promoting solar still technologies to clean up water supplies along the Texas border. Their support and encouragement have been critical for the EPSEA stills project and development of this manual.

We also want to recognize Dr. Rudi Schoenmakers of the Southwest Technology Development Institute (SWTDI) at New Mexico State University for his support in going where others wouldn't tread and working with the El Paso Solar Energy Association on this project. Special thanks to SWTDI Project Coordinator Kenny Stevens and Dr. Walter Zachritz for their dedication to the project. The assistance of Omar Carrillo and Carol Fischer of SWTDI for this project are greatly appreciated.

Horace McCracken played a key role to the success of this project by allowing EPSEA to work and learn from his many years of experience with solar distillation. His 40 years of expertise saved us years in developing a dependable solar still. His dedication to solar energy is highly commendable.

Finally, but certainly not least, the support of the Board of Directors and the membership of the El Paso Solar Energy Association have been critical for this project. Particular thanks to Steve Cook and Hector Gasquet for their encouragement throughout this project and its development. We also appreciate the support of Gary Ashe, who donated critical space at the Eastside Mini-Warehouses for the project. It is a *real pleasure* to work with such a group of dedicated solar pioneers. We have only yet begun.

DISCLAIMER OF LIABILITY AND ENDORSEMENT

Solar Still Background

Solar distillation is a well known technology. The first known use of stills dates back to 1551 when it was used by Arab alchemists. Other scientists and naturalists used stills over the coming centuries including Della Porta (1589), Lavoisier (1862), and Mauchot (1869).

The first "conventional" solar still plant was built in 1872 by the Swedish engineer Charles Wilson in the mining community of Las Salinas in what is today northern Chile (Region II). This still was a large basin-type still used for supplying fresh water using brackish feedwater to a nitrate mining community. The plant used wooden bays (1.14 m by 61.0 m) which had blackened bottoms using logwood dye and alum. The total area of the distillation plant was 4,700 square meters. On a typical summer day this plant produced 4.9 kg of distilled water per square meter of still surface, or more than 23,000 liters per day (>6,000 gallons per day) (Harding, 1883). This plant was in operation until 1912. Even today one can find thousands of shards of glass and chunks of accumulated salt at this historical solar site.

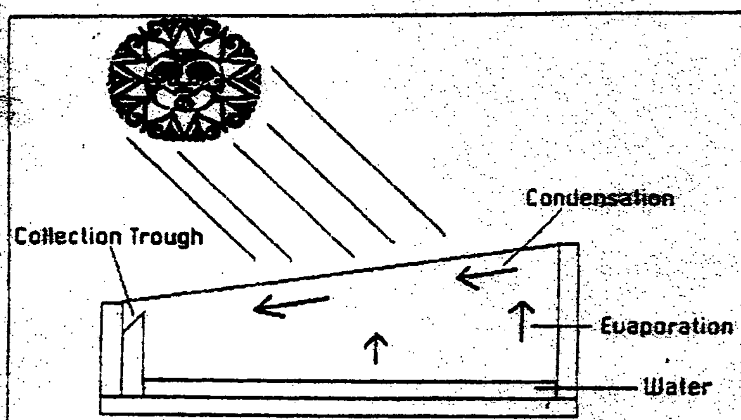
Over the past century, literally hundreds of solar still plants and thousands of individual stills have been built around the world.

Still Operation

A solar still operates on the same principle that provides rain: evaporation. The water from the oceans evaporates, only to cool, condense and return to earth as rain. When the water evaporates, it removes only pure water and leaves all contaminants behind.

A typical single basin solar still has a top cover made of glass, with an interior surface made of a waterproof silicone membrane. This interior surface uses blackened silicone to improve absorption of the sun's rays. Water to be cleaned is poured into the still to partially fill the basin. The glass cover allows the solar radiation (short-wave) to pass into the still, which is mostly absorbed by the blackened base. The water begins to heat up and the moisture content of the air trapped between the water surface and the glass cover increases. The base also radiates energy in the infra-red region (long wavelength) which is reflected back into the still by the glass cover, thus the glass cover traps the solar energy inside the still (the "greenhouse" effect). The heated water vapor evaporates from the basin and condenses on the inside of the glass cover. In this process all of the salts and microbes that were in the original water are left behind. The condensed water trickles down the inclined glass cover to an interior collection trough and is delivered to a storage bottle. This technology is effective for brackish water, heavy metals and also against bacteria such as cholera and E. Coli.

The still is filled each morning or evening, and the total water production for the day is collected at that time. The still will continue to produce distillate after sundown until the water temperature cools down. Feedwater should be added each day that roughly exceeds the distillate production by half or more to provide proper flushing of the basin water and to clean out excess salts left behind during the evaporation process.



Silicone sealant is one of the best materials available for making an acceptable, long-lasting membrane that does not give the distilled water any type of strange after taste. It is important to use a food-grade approved silicone for the still membrane for this purpose. In fact, solar distilled water actually tastes quite good and sweet, not like the distilled water purchased at the supermarket that tastes flat. Solar distilled water does not acquire the "flat" taste of commercially distilled water, which results from the boiling process.

Solar stills can easily provide enough water for family drinking and cooking needs. Stills can be used in areas where water is contaminated and total dissolved salt concentrations are extremely high, such as seawater. The EPSEA stills have been well received by users. For instance, the mother of a family in San Elizario that received an EPSEA still decided to see whether or not her children could tell the difference between solar distilled and store bought drinking water. She secretly substituted drinking water from the supermarket for solar distilled water in the refrigerator. Her children immediately tasted the difference (without even knowing they were participating in a taste test experiment) because the store bought drinking water did not taste as "sweet" and good as the solar distilled water.

Solar still technologies bridge the gap between currently inadequate water and sewage conditions in many places of the world such as El Paso County and centralized water purification systems that are planned for the future. In many developing regions of the world where there is little possibility of any type of centralized water treatment system, stills provide an immediate, inexpensive, and simple solution for good, clean drinking water. Stills can be used anywhere the sun shines. Solar still technologies bring immediate benefits to users by alleviating chronic health problems, birth defects, and death caused by water-borne disease. Stills can ultimately reduce potential users pain, discomfort, and health care needs due to contaminated drinking water. This in turn can help provide people more active and productive lives. Solar stills can be a lifesaving technology for many persons worldwide in preventing deadly and debilitating water borne diseases.

Inclined glass solar still basic operation

The intensity of solar energy falling on the still is the single most important parameter affecting production. The daily distilled water output (M_e in kg/m2 day) is the amount of energy utilized in vaporizing water in the still (Q_e in J/ m2 day) over the latent heat of vaporization of water (L in J/kg). Solar still efficiency (n) is amount of energy utilized in vaporizing water in the still over the amount of incident solar energy on the still (Q in J/m2 day). These can be expressed as:

Solar still production:
$M_e = Q_e / L$

Solar Still Efficiency:
$n = Q_e / Q_t$

Production rates in the El Pas area should minimally averag about 1.5 gallons per day in th winter to over 3.5 gallons per da during the summer.
see graphic - next page.

Stills are modular and for greate water production requirement several stills can be connecte together in parallel.

General operation is very simpl and requires facing the still to wards solar noon, putting wate in the still every morning to fi and flush the basin, an recovering distillate fro the collection reservoi (e.g., glass bottles).

Stills are highly durabl and should last for 2 years or more as has bee shown by Horac McCracken. Durabilit of the proprietary sil cone lining is also 20 c more years. The glas surface is tempered an should withstand gol ball size hail. Stills ar unaffected by freezing When glass bottles ar used to collect distilled wate they should be protected fron freezing during the winter. Still require no replacement parts an are virtually maintenance free.

It is important to emphasize tha the still basin needs to be flushe daily by adding in mor feedwater than is produced a distillate. This excess wate could be used for irrigation i desired, although it will have a high salt concentration. Roughly the operator should add ir double the feedwater that is produced as distillate on a daily basis. It is extremely important never to allow the still to go dry and operate in the direct sunlight. This will immediately cause the still basin base to turn white (from salts) and the silicone begins to literally bake and outgas. This outgas will leave a small

film on the underside of the glass that will prevent water drops from properly trickling down the glass to the collection trough, but rather the glass will form large drops that fall back into the basin (a "short-circuit"). The glass can be cleaned afterwards, but this requires removing the glass and cleaning it with a weak acid solution. If the solar still must be left unattended for several days, it is important not to let the still dry out. The solar still should be filled with water and the glazing covered (e.g., plywood) with all silicone tubing pinched to prevent water loss so that the still will simply recirculate water internally. Following these simple operating requirements and your solar still will provides years of useful service.

How Good is Bottled Water?

The bottle water industry in the U.S., as well as around the world, is not well regulated or tested. About one quarter of all bottled water in the U.S. comes from the same rivers and lakes as municipal water supplies. In 1995, 2.43 billion gallons (nine gallons per each American) of bottled water were sold in the U.S (Uehling, 1996).

The only way to be sure of the quality of bottled water is to find out how the water was processed. In a few cases, government tests have found aresenic, bacterica, and industrial compounds in bottled water. Overseas, the rate of contamination of bottled water is even worse in many developing countries.

The terms used on bottled water are not well regulated by the FDA. Many terms are for marketing purposes such as "pure," "natural," "organic," and "100%," all of which are meaningless. It is perfectly legal to sell "glacier" water produced from the contaminated water of the Rio Grande in El Paso, Texas. Water that is purified or distilled before bottling does not need to be labeled with its source. Thus, bottled water can be coming from the same source as your tap water. Some terms that are sanctioned by the FDA are confusing as well: "spring" water does not need to flow out of a spring, it only has to have the same composition as water that does so nearby. "Mineral" water refers to water with less than 250 ppm total dissolved salts, not water from under a rock in a pristine alpine meadow (Uehling, 1996)..

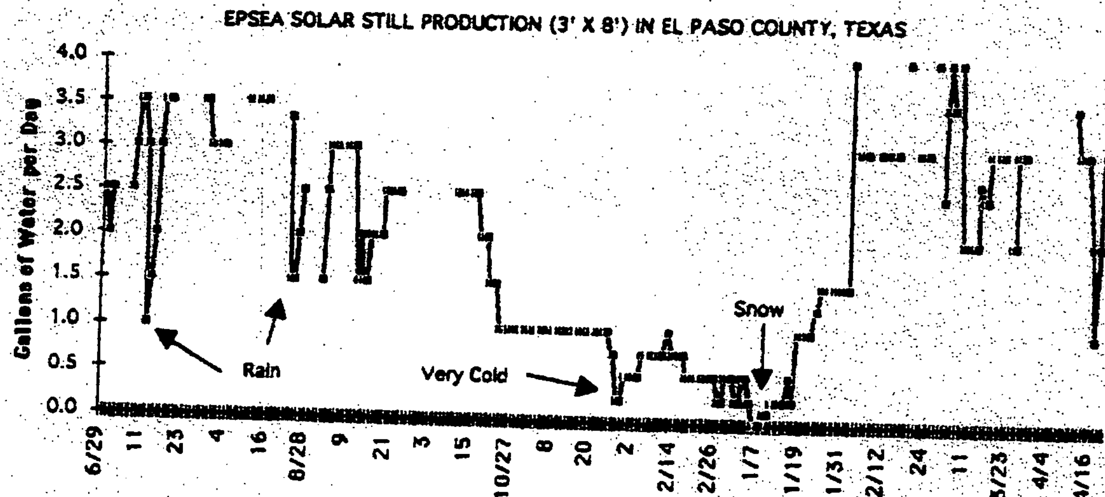
A few of the regulated useful phrases for buyers of bottled water are "artesian," which means well water from contained underground bodies of water, which are more protected, but not completely immune to agricultural runoff and industrial contaminants. "Purified" indicates water that has been treated in one of four ways: disinfected with ozone, filtered through absorbent carbon, distilled by boiling, or filtered through a membrane by reverse osmosis. Purified and artesian water should be free of lead (Uehling, 1996). Solar distilled water will almost always be of superior quality to bottled water sold in stores or filtrated/reverse osmosis water produced at home.

Economics of Solar Distillation

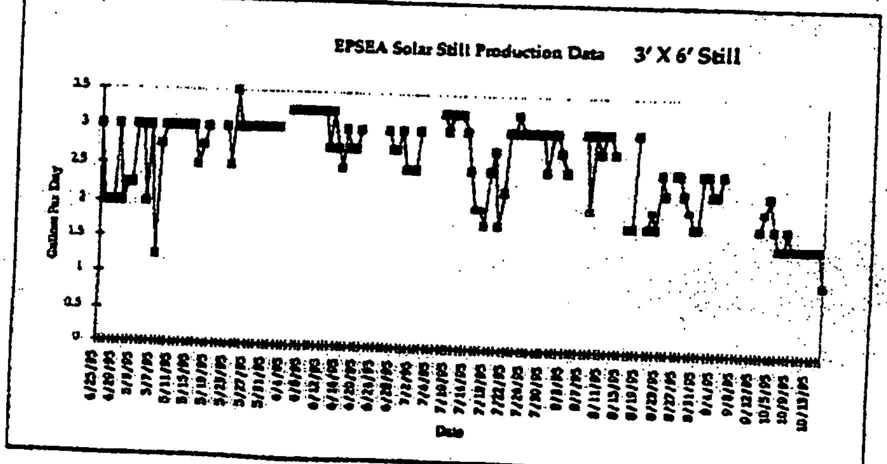
The EPSEA solar still effectively eliminates water borne pathogens and salts. Stills are highly portable, with an installation time of less than 30 minutes. Stills only use passive solar energy and do not require a pressurized water supply. They can be sized to meet the needs of one person or family, as well as a small community. Stills are cost competitive for family use.

Compared to the cost of bottled water, the average return on investment for a solar still is only a couple of years at most, even with the most expensive stills purchased at a retail cost that typically averages about $700. A user can build their own still for less than $300 in materials. If compared to the health "costs" of contaminated water, payback for a solar still is immediate. Even compared to buying purchased water from the grocery store, payback is rapid for a solar still.

The best bottled water often costs more than gasoline. Many families that EPSEA has worked with in the colonias often spend from $8 to $12 per week (often about $1.00 per gallon for drinking water). This represents an investment of $416 to $624 per year for bottled water. A solar still could be built or purchased to provide even more drinking water over the year for a similar price. Thus, simple payback on a solar still strictly compared to purchasing bottled water is less than two years.



June 29, 1996 to April 21, 1997



Solar Still Water Purification Capabilities

Solar stills have proven to be highly effective in cleaning up water supplies to provide safe drinking water. Tests conducted onMcCracken solar stills nearly identical in design and materials to the EPSEA still at New Mexico State University and Sandia National Laboratories have conclusively shown that solar stills are highly effective in eliminating microbial contamination and salts. Also, it is important that people eat a balanced diet to get the minerals and vitamins needed since distilled water is devoid of salts and minerals.

New Mexico State University Still Tests

Tests conducted by Dr. Carol M. McCarthy of the Department of Biology at New Mexico State University in 1992 have shown that when properly set up and used, the solar still will eliminate bacteria in its feed water supply by 99.65% or greater. The still feedwater was deliberately spiked with Coliform bacteria to see how effective stills are in removing bacteria. Cold tap water from the laboratory was used as the supply. Two liters were introduced daily and the distillate was removed daily for culture.

The *E. coli* seed was grown in 20 ml trypticase soy broth (TSB) overnight (37°C, 150 rpm). During June, it was directly introduced into the two liters of nonsterile supply tap water. During July, the seed was centrifuged, the TSB decanted and the cell pellet resuspended in the supply tap water.

For viable counts, a volume of up to one liter was caught on a sterile 0.45-µl pore, 47 mm filter (Gelman Metricel) and the filter was placed on the appropriate medium. Where necessary, dilutions were made in 0.1% peptone and 20-µl was spotted onto the appropriate medium. For total counts, NWRI medium was used; the plates were incubated at 23°C and counted after 6 to 7 days. For *Escherchia coli*, m-Endo medium was used; the plates were incubated at 35°C for 24 hours.

The protocol and media recipes may be found *In* Clesceri, L. S., A. E. Greenberg, R. R. Trussell (ed.). 1989. Standard methods for the examination of water and wastewater, 17th ed., Part 9215, Heterotrophic plate count. American Public Health Association, Washington, D.C.

Daily, from 7/11/92 through 7/14/92 the still was seeded with *E. coli* cells, from 6 million to 16 million per two liters supply. One liter of distillate was tested each day from 7/11/92 through 7/15/92 for *E. coli* viable cells and none were detected from the distillate.

The table below provides the results of the NMSU tests which show the effectiveness of solar stills in eliminating microbial contamination. After the introduction of more than 10,000 viable bacteria per liter in the feed water, 4 and 25 viable cells per liter were found in the distillate (reductions of 99.96 and 99.65% were achieved). Introduction of a billion or more *Escherichia coli* viable cells, each day over a period of fivedays, did not change the number of viable cell numbers recovered in the distillate, nor was *E. coli* recovered in the distillate.

NMSU Still Water Quality Test Results

Date	Sample	Volume Tested	Total Organisms per liter
6/26/92	Distillate	1,000	12
6/27/92	Supply	50	16,000
	Distillate	1,000	4
6/29/92	*E. coli* Seed	—	2,900,000,000
	Distillate	750	11 (No *E. coli*)
6/30/92	*E. coli* Seed	—	7,500,000,000
	Distillate	1,000	18 (No *E. coli*)
7/1/92	Distillate	1,000	35
7/2/92	Supply	10	24,000
	Distillate	1,000	13
7/3/92	Supply	1	12,000
	Distillate	1,000	6

Source: McCarthy, 1992

Sandia National Laboratories Still Water Quality Test Results

In 1991, Sandia National Laboratories (SNL) set up a McCracken solar still to test water quality. The SNL tests were conducted with supply water concentrations of 13 and 16% (standard saltwater). The stills effectively removed salts and the Total Dissolved Salts (TDS) concentration of the water fell from 36,000 and 48,000 TDS to less than 1 TDS. The SNL report also concluded that solar stills are effective in producing coliform free water (Zirzow, 1992). The table below shows results from the SNL tests. Source: Zirzow, SAND92-0100, 1992

SNL Still Water Quality Test Results

Collection time	8:50 a.m.	2:20 p.m.	9:15 a.m.	3:00 p.m.
Collection date	9/4/91	9/4/91	9/5/91	9/5/91
Sample Type	13% salinity feedwater	Distilled water (13% case)	16% salinity feedwater	Distilled water (16% case)
Calcium (total)	340	1.5	371	<0.10
Iron (total)	0.27	<0.05	0.48	<0.06
Magnesium (total)	2.1	2.1	<0.005	<0.005
Manganese (total)	0.04	<0.02	0.07	<0.02
Ammonia as N	<0.1	0.1	<0.1	<0.1
Chloride	19000	<1.0	25000	2.6
Fixed Solids	32000	<1.0	41000	31
Nitrate as NO_3	34	0.1	26	<0.1
Nitrate as NO_2	0.013	<0.01	0.02	<0.01
TDS	36000	<1.0	48000	<1.0
Volatiles & Organics	4200	<1.0	6000	13

Source: Zirzow, SAND92-0100, 1992

Updates - Test Results - Revisions

EPSEA will establish a web page specifically for everyone who has purchased construction plans. The site will provide information on results of still testing being conducted at New Mexico State University (NMSU). Results will include a list of the various contaminants introduced to supply water and test results. To date we do know that the stills effectiveness have been very impressive. As to the quality and taste of the water, we know that NMSU personnel are drinking the still water and it is also being used in the laboratory where it has been found to be of higher quality than "store bought" distilled water.

We'll also pass along information on variations of the basic plans including water production of the still when insulation values have been doubled. Another variation, yet to be tested, is the addition of a reflector and its effect on production.

We will add clarification to the plans and post more pictures in response to repeated questions on certain aspects of construction. Video???

Your Role

We need your feedback! Everyone who constructs a still can contribute information to the site which will help others. What materials did you use for siding? Where did you buy silicone or tubing? What size is your still? What tool do you prefer for spreading silicone? What improvemnet did you make? Pleae share your tips and tricks!

As time allows we can assemble a FAQ page to assist others. An especially important feature would be targeted at students who often write looking for assistance with Science Fair projects.

What else would you like to see?

www.epsea.org/mystill.html
email: epsea@txses.org

Solar Stills
Lessons Learned

A wide variety of experience has been gained by EPSEA regarding solar stills. Ultimate still acceptability depends greatly on end-user willingness to operate a still. Solar stills are kind of like pets, you have to feed them every day (in this case, water). Some people know how to take care of pets, others don't. It is no different with solar stills. EPSEA has found that solar still operation and ultimate success is dependent on end-user motivation and care.

The greatest problem for a solar still is if it dries out. This causes the silicone to outgas, which then deposits a fine film on the glass, causing the water droplets to bead up and fall back into the basin rather than trickle down the glass to the collection trough. Stills can dry out in as little as three or four days in the summer. Thus, it is absolutely critical that the end-user does not let a still dry out, otherwise still water production drops dramatically (on the order of 80%). If a user leaves time, all that has to be done is pinch the silicone tubes shut and operate the still in "short-circuit."

EPSEA stills rarely develop leaks because they use an extra reinforced fiberglass mesh in the corners that prevents leaks. EPSEA also "cures" stills after silicone is applied for at least two weeks before applying glazing and then tests them for leaks before a still is considered ready. If a still is not allowed to cure, Glass distillate collection bottles full of water can break in the winter if left outdoors during a hard freeze. Water expands and cracks the glass.

Finally, not all people are destined to build successful solar stills. The worst example we've seen is one "stubborn" development group in northern Mexico that did not want outside assistance (despite the offer). They went at it alone and thought they would be smart by cutting a few corners and trying to save a few dollars. They built poor quality stills that leaked, but what was worse was they used the wrong materials for constructing stills. Instead of using the FDA food-grade approved silicone, they used a more inexpensive regular silicone purchased at a local hardware store. This type of silicone is not rated to come into contact with items (e.g. water) for human consumption. Thus, they built eight stills, never tested them (always suspect development groups that don't practice what they preach), and shipped them ou to a Native American community in Chihua hua. These stills caused the local people to get sick with dizziness and vomiting. This was an unfortunate and avoidable inciden that demonstrates the importance of building stills with the right materials.

EPSEA firmly believes that solar stills are a excellent technology for application in the colonias and similar undeveloped area around the world. Stills are also useful i developed regions. Stills are highly effectiv in cleaning contaminated water of both salt and pathogens. EPSEA is continuing worl with New Mexico State University in identi fying the capabilities of stills in determinin what all toxins solar stills can clean (e.g., fer tilizers, pesticides), as well as further poten tial design improvements (e.g., does mor insulation provide significant more wate production, most optimal glazing slope, etc.) The EPEA basin still is a good solid and af fordable solar still that can provide years o useful service.

Resources

Cormier, M., "El Paso Solar Energy Association Water Purification Project," presented to the United Nations Development Program, Nev York, New York, September 12, 1995.

Cormier, M. and R. E. Foster, "Solar Energy for Water Purification and International Markets," American Solar Energy Association Confer ence, Minneapolis, Minnesota, July 19, 1995.

Cormier, M., "Solar Stills," *SEASUN*, El Paso Solar Energy Association, El Paso, Texas, April, 1995.

Cormier, M., Foster, R. E., and G. Cisneros, "EPSEA Solar Still Construction and Operation Manual," El Paso Solar Energy Association Texas Renewables '95, El Paso, Texas, November 16, 1995.

Dunham, Daniel C., Fresh Water From the Sun - Family-sized Solar Still Technology: A Review & Analysis, Office of Health, United State Agency for International Development, Washington, D.C., August, 1978.

Foster, R. E., "Bienvenidos a la Frontera Solar," *SEASUN*, El Paso Solar Energy Association, El Paso, Texas, December, 1995.

Foster, R. E., Cormier, M., "Solar Distillation: EPSEA Solar Still Contruction and Operation Manual," El Paso Solar Energy Association, E Paso, Texas, August, 1996.

Malik, M. A. S., Tiwari, G. N., Kumar, A. and M. S. Sodha, Solar Distillation, Pergamon Press, New York, New York, 1982.

McCarthy, C. M., correspondence to Horace McCracken, Department of Biology, New Mexico State University, Las Cruces, New Mexicc August 25, 1992.

McCracken, H., "Solar Distillation: Practice and Promise," *Solar Today*, American Solar Energy Association, Boulder, Colorado, Vol. 9, No 2, March/April, 1995.

Uehling, Mark D., "How Safe is Your Water," *Popular Science*, Times Mirror Magazines, New York, New York, October, 1996. pp. 63-68

Zirzow, Jeffrey A., Solar Stills Complement Photovoltaic Systems, Sandia National Laboratories, SAND92-0100, Albuquerque, New Mexico February, 1992.

EPSEA

The El Paso Solar Energy Association was chartered in 1978 as a non-profit organization. For more than 20 years, EPSEA has held monthly meetings/seminars and published the monthly newsletter, *SEASUN*. EPSEA distributes 1,000 copies of the *SEASUN* each month. EPSEA has maintained a presence on the World Wide Web since 1994 and today it's web site averages more than 1,000 visitors each day. EPSEA is a volunteer organization and has no paid staff.

EPSEA has evolved into a regional organization, serving West Texas, Southern New Mexico and Northern Mexico. While the core membership is made up of individuals from these areas, EPSEA continues to receive support from members world wide.

EPSEA's Mission Statement

The purpose of EPSEA is to further the develop ment of solar energy and related arts, sources and technologies with concern for the ecologic, socia and economic fabric of the region. This shall b accomplished through exchange of ideas and in formation by means of meetings, publication, in formation centers and the World WideWeb. Th Associaiton shall serve to inform the public, in stitutional and governmental bodies and seek t raise the level of public and governmental aware ness of its purpose.

:PSEA Solar Still Parts List

reated 2 X 4 wood: 2@14 (or 2@8', @12')

sheet 4' X 8' X 1" foil faced insulation polyisocyanurate)

sheet 4' X 8' X 1/2" exterior plywood dx or OSB

Aluminum foil tape, 30 feet minimum

Fiberglass window screen - approx. 36 sq. Ft.

19+ tubes black silicone (Dow Corning 999-A)

Usually available through glass/plastics shops.

Glass 34" X 76" (tempered preferred, patio door replacement)

5 gallon Plastic bucket w/lid

5 gallon Glass jug (car boy)

8d nails, 50 pcs.

20 pcs. #8 X 3" screws or 16d nails

2 pcs. 5/16" X 4" bolts/nuts / washers

Siding material approx. 12 square feet

*18" silicone tubing 3/8" i.d.

*12" silicone tubing 1/2" i.d.

*Silicone primer

*May not be locally available "off the shelf"

Sources for silicone products include Medical Supply Shops and Industrial Hose - Tubing Suppliers

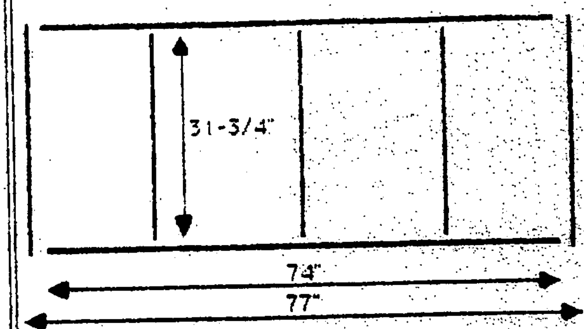
EPSEA Solar Still Assembly

FRAME

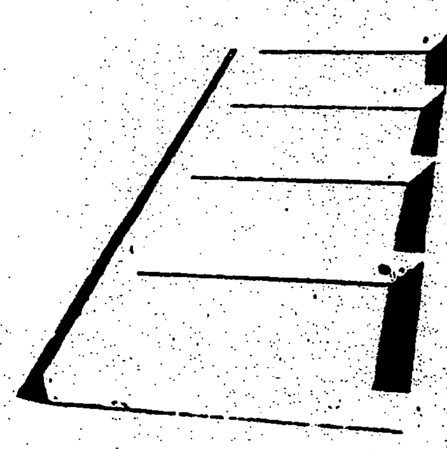
(2 @14')

Base Materials: 2 X 4 Treated Lumber

CUTS
2 pcs - 74"
3 pcs - 31-3/4"
2 pcs/- 34-3/4"
1 pc. - 19" *
* for water bucket



Nail together with 16d nails or wood screws

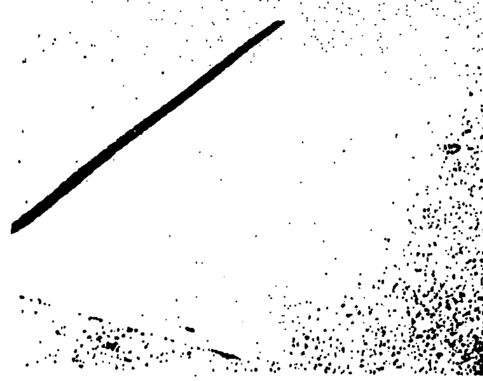


Solar Still Frame

BOTTOM BASE

PLYWOOD 1 PC. 1/2"X4'X8'
CUT - 34-3/4"X77"
Nail to 2 x 4s w/8d nails or use 1-1/4" wood screws

Keep frame square when attaching plywood. Align uncut end and side edge of plywood with 2X4 frame and secure with nails/screws. Finish other end and side.

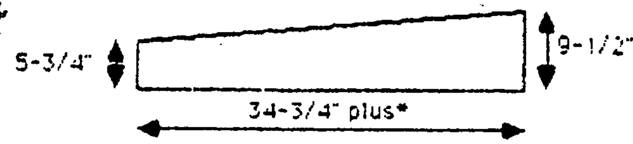


Solar Still Base

SIDING MATERIALS

The material of choice for siding should be a local or regional material.
Use what you have available! EPSEA uses a concrete siding, which holds up well in desert environments.

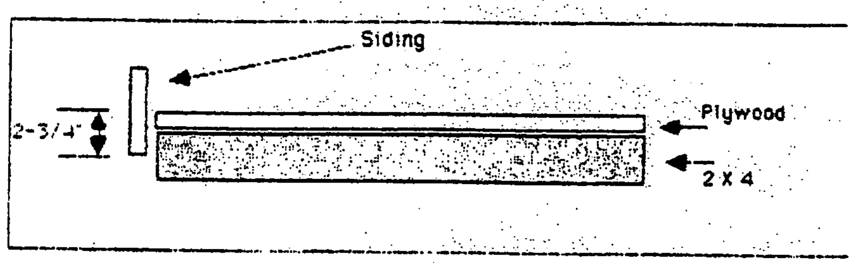
CUTS
North: 9-1/2" X 77"
South: 5-3/4" X 77"
East/West: 2 pcs. 5-3/4" X 9-1/2" X 34-3/4"
*plus thickness of N. & S. pieces



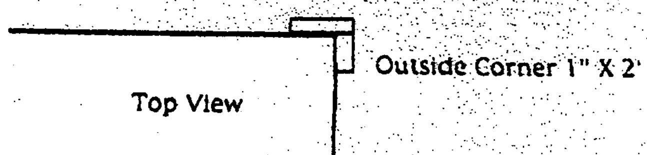
ATTACH SIDING

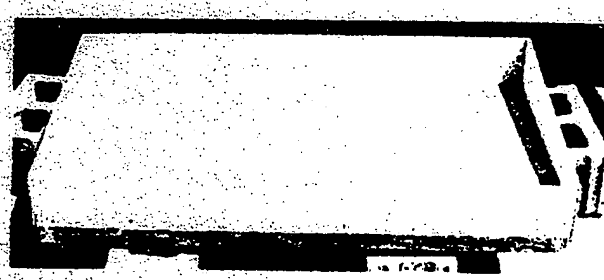
Siding is attached to base 2 X 4s using wood screws, which are long enough to enter a 2 X 4 by at least 3/4".

Mark siding 2-3/4" up from bottom edge. Install siding so mark aligns with top edge of base plywood.



If needed for additional strength, attach 1" X 2" pieces at corners and glue & nail/screw together.



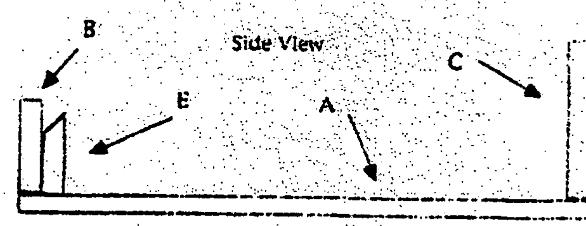


Solar Still Base with Siding Attached

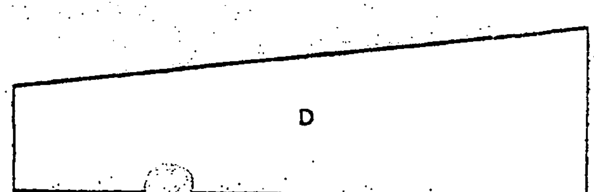
INSULATION

1 Sheet - 1"X48"X96" - Foil Faced Polyisocyanurate
(a foil face is necessary to better adhere the membrane.)

CUTS
A = Base - 34-3/4"X77"
B = South pc. - 2"X77"
C = North pc. - 5 3/4"X77"
D = East & West 2pcs.@2-1/8"X5-3/4"X32-3/4"
E = Trough pc. - 1-3/4"X75"

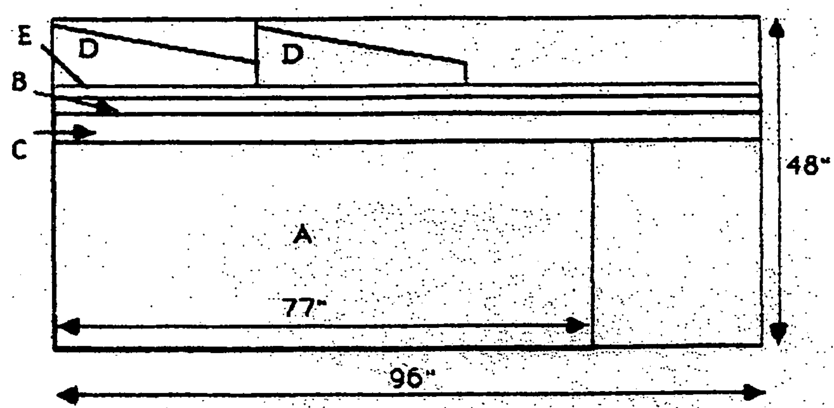


Insulation Cuts



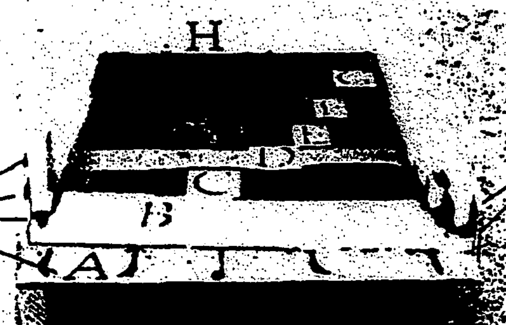
NSULATION CUTS: To get the most out of your sheet of rigid insulation, cut as follows:

CUTS
A = Base - 34-3/4"X77"
B = South pc. - 2"X77"
C = North pc. - 5 3/4"X77"
D = East & West
2pcs.@2-1/8"X5-3/4"X32-3/4"
E = Trough pc. - 1-3/4"X75"



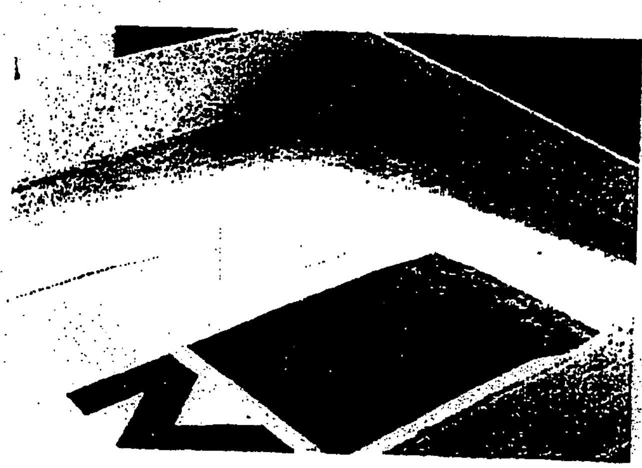
NSULATION ASSEMBLY

All exposed insulation edges are covered with aluminum tape.
All pieces are installed and joined together with silicone.



Attach insulation base to plywood using silicone

Silicone on base ready for placing rigid insulation board on top of plywood

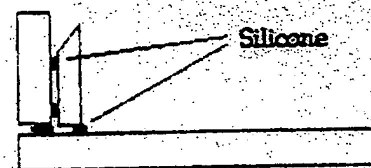


Rigid foam insulation placed on top of siliconed still base

North and South Pieces
Put large bead of silicone along top of base where pieces will meet.
Apply bead of silicone along siding approximately 1/2" down from the top of siding and another bead 1/2" up from bottom.

Attach: Without disturbing silicone bead at bottom (base), hold insulation 1/2" above siding and press insulation into silicone along entire length. Continue to press into siding while also pushing entire piece down onto base insulation and silicone joint. (tool joint using finger method below)

Attach east & west pieces - same procedure as above but with additional bead of caulking at ends where side pieces meet north and south pieces. (right)

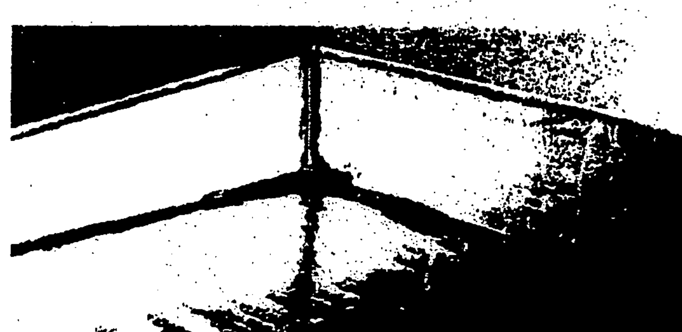


Attach trough
Trough angle is approximately 45 degrees

Finger method

• Caulk all insulation joints. Wet your index finger and go over all joints quickly. This method forces the silicone into the joints and results in a smooth finish. Silicone is easily removed from finger if wiped off immediately. Allow to dry and re-caulk all joints.

Finger smoothing method

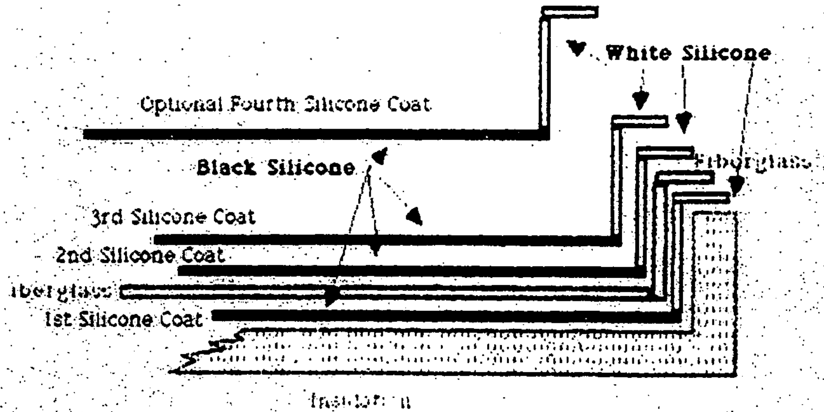


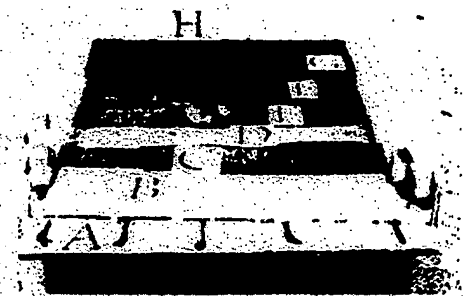
All insulation joints caulked

EPSEA Still Membrane Assembly

Proper assembly of the membrane is critical. The result is a still that DOES NOT LEAK.

he membrane assembly is a 3 step process; a thin coat of silicone, followed immediately with fiberglass screen and a second thin coat of licone. Allow to dry a minimum of 1 hr. and then apply a third thin coat of silicone. Some folks will apply a fourth coat of silicone.





A - Plywood Base
B - Insulation
C - 1st layer silicone
D - Fiberglass screen
E - Screen imbedded in silicone
F - 2nd coat of silicone
G - 3rd coat of silicone

IATERIALS 19 + tubes of black 999-A silicone

Fiberglass window screen. Approximately 36 sq. ft.

lote: The use of white silicone on the side walls does not make an appreciable difference system performance. If you prefer to use white for side walls then the tal count is 12 tubes of black and 7 white

ONLY USE FDA APPROVED FOOD-GRADE SILICONE (Dow-Corning 999-A).)ther unapproved silicone can make you ill if used inside the still.

OOLS: Scissors
8" dry wall knife (trowel)
caulking gun
paper towels/rags

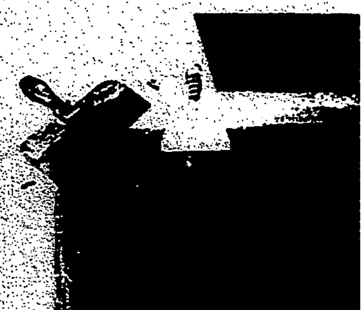
- Do not assemble membrane without sufficient ventilation.
- All exposed insulation will be covered with the membrane and it will extend to cover the top edge of the siding material.
- Primer: All parts covered by membrane should first be coated with silicone primer. Allow primer to dry 15 - 30 minutes before applying silicone. If silicone is not applied within 8 hours the area must be re-primed. A small amount of primer covers a large area and is easily spread with a paint brush.
- Dry fit the fiberglass screen. It's easier to start with a single piece that will fit the basin, extend up all sides, with enough left over to cover the top edge of the insulation and siding. Cut the screen in the corners to allow overlapping. Cut straight up, starting in the corner.
- You may also use smaller pieces, with all joints overlapping by 3/4". It's best if the basin is made of one piece extending up all sides a minimum of 1". This eliminates any joints where the base meets the side walls. A 36" wide piece will extend up the side walls by 1". The length of the fiberglass should be left long enough to cover both ends and extend over the top of the insulation and siding.

Dry fit of fiberglass screen placed into still interior before applying silicone

Once screen for base is set in place, weigh down one end to keep in position. Take unweighted end and fold back toward weight

Important: Silicone sets up in only a few minutes. Work fast in applying the first 2 coats of silicone. Cut open a few tubes of s below the tapered end, and puncture seal with a nail. If the silicone starts to drag, rather than spreading easily, it is setting up this happens, you're better off to let it dry and fix it later. The more you mess with it, the messier it gets. The silicone will come c hands easily if you wipe it off right away.

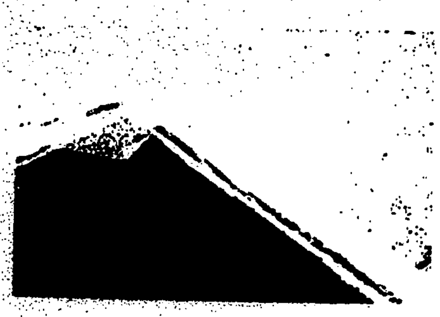
- Start with the base, and work small areas. (the width of the base by no more than 2'). Squirt silicone on the base in multiple s approximately 2'-3" apart. Be sure to apply a bead at insulation joints.
- Quickly spread silicone evenly using dry wall knife. The silicone is probably applied thinner than you would imagine, but us more silicone is cheap insurance against a leak.



spread silicone with a dry wall knife

Strips of silicone on top of rigid foam insulation before spreading

- Lay the fiberglass back down in position and using the drywall knife, imbed the screen into the silicone.
- Immediately apply the second coat of silicone over the screen. The second coat barely covers the screen.
- Lay 2 - 2X4's across the still above the completed section. Remove weights from screen and now fold screenback and rest on th 2X4s.
- Continue working 2' sections until finished with the base.



Black silicone coat on top of fiberglass

Ends and North Wall

Fiberglass for north wall should overlap bottom piece by minimum 3/4" and extend up and over top and siding. Cut length to allow for overlapping at corners. Where fiberglass folds at corners, it will need to be cut in order to fold over top edge. Cut up t top of insulation.

Trough

- The trough is probably the trickiest of all. It may be easier to use strips of 2' long fiberglass here.
  Cut fiberglass in widths long enough to overlap base fiberglass X 1/2" (minimum) and then fold through trough and extend ov exterior insulation and siding.
- Install first along basin side, overlapping basin fiberglass by 3/4" minimum. It may be easier to allow this to set up before maki the fold into the trough as this tends to pull the fiberglass from the side. When forming the trough, the "wet finger" method wo well and ensures a better finish.

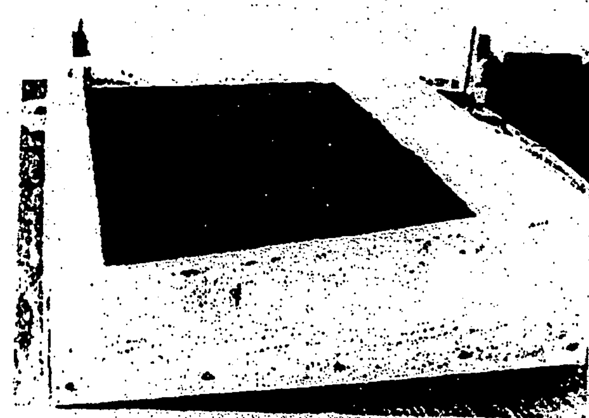
ıird Coat

Allow silicone to dry at least 1 hr. before applying e third coat. First, re-caulk all joints, using the wet nger method.

When third coat has dried, re-caulk the bottom joints ith finger finish.

Use utility knife to trim excess fiberglass along ges.

The top edge can be touched up, with more silicone preparation for the glass.



Tubing: Drill from the inside, the holes for the inlet/overflow(3/4") and outlet tubing(1/2").
The inlet/overflow holes start 3/4" above basin.
The outlet tube hole is drilled at the end of the V in the trough. Push tubing in from outside an extra 1" and silicone around tube inside the still and pull tube to within 1/4" of edge. Finish with wet finger method.
(the tubing maybe installed after the 2nd coat has dried - allow silicone to dry again and proceed with 3rd coat)

Water test. Before installing glass, place the still outside, level and fill the still until it overflows, and allow it to sit at least 24 hours. Pinch off the outlet tube and fill the trough. If there are any leaks, empty the still, allowing it to dry, and repair leaks with silicone.

With product outlet tube open, slowly fill trough from opposite and to ensure that water drains out through tube and does not back up and overflow back into basin. Fix any low spots on trough edge with additional silicone.

Clean the glass!

Lay glass on top and apply silicone at joint where the glass and top of still meet. This is enough for a water tight seal, and should you need to remove the glass later, the silicone is easily cut with a utility knife.

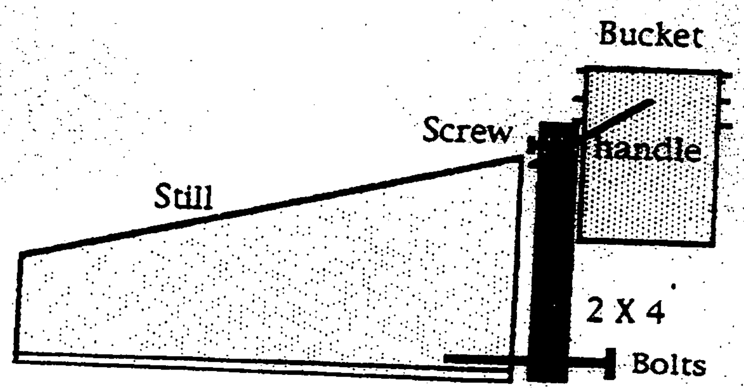
Water Supply Bucket Installation

A 5 gallon plastic bucket is used to fill the still. We use a plastic, evaporative cooler stand pipe installed through the side of the ıcket, approximately 1" from the bottom. Use tubing to connect bucket to still fill hose. Some owners also directly connect a hose to e still to fill without using a bucket.

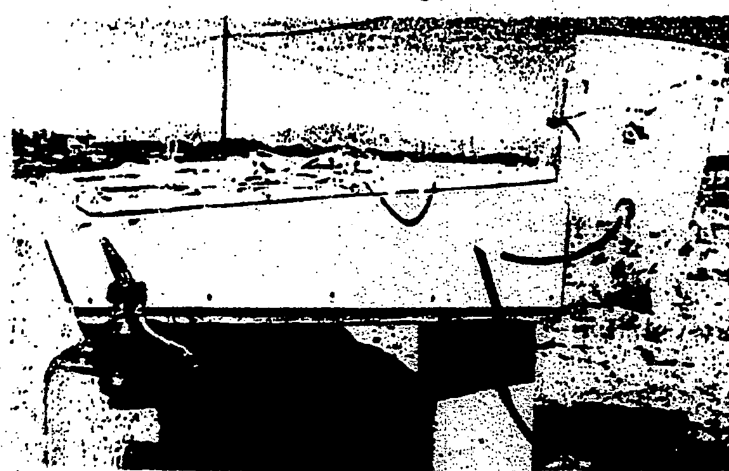
The 19" piece of 2 X 4 is bolted to the still 2 X 4 base with two 4" X 5/16" bolts/nuts/washers.

Drill two, 3/8" holes 3/4" and 2-3/4" from the bottom of the 2 X 4. Align the bottom of the 2 X 4 with the bottom of the 2 X 4 base. Mark and drill corresponding holes through the base 2 X 4. Attach with bolts.

Remove plastic hand grip (if equipped), from bucket handle. The lip of the bucket rests on top of 2 X 4, and the metal handle is pulled down over 2 X 4 and secured with a screw. If you will leave the bucket in direct sunlight, it is best to cover it with a tarp or similar product, or paint the outside, to prevent accelerated UV sunlight degradation of the plastic bucket.



RNING! DO NOT expose an empty still TO SUNLIGHT, as the extreme heat could damage it by causing outgassing (see owners ıanual). When moving the still, keep it covered. Install the still, fill with water, then remove the glazing cover.



Covered EPSEA Basin Still, installed and ready for water.
It is important to cover the still glazing when there is no water so that it does not operate dry.

STILL OPERATION

Follow a few simple guidelines and your solar still will provide you with clean drinking water for many years to come.

SETTING UP THE STILL
Site the still so that it will face south. The short side of the still should run north to south. The sun is at solar south at the time of day between sunrise and sunset. The most common stand for the still is 4 concrete blocks.
This elevates the still and makes it easier to collect the water.

THE STILL MUST BE LEVEL

Level the still from side to side and front to back. Note the glass on the still is not designed to be level (it is inclined 10-15° to allow water to properly trickle down it). You must level the still based on one of its horizontal planes, such as the back top edge or the bottom still base, not the glass cover or slanted top sides. Mount the 5 gallon bucket on the stand and connect the fill line from the bucket to the inlet tube on the still.

Fill the still until water flows from the overflow tube. In normal operation, you will add at least an additional 2 gallons after the still starts to overflow. The extra water is necessary to flush the still of contaminants or salt left from the previous day. The water from the overflow can be used for irrigation. If your supply water is very salty (e.g., brine, or sea water) use more water to flush out the excess salts left behind from evaporation.

Completed solar still leveled during final installation.

IF YOUR STILL IS NEW

- Do not drink the water for the first three days on a newly constructed still. The new still must be cleaned by running it for a few da to get any contaminants on the glass and collection trough from the construction phase. The water might have a slight silicone taste for a few weeks, but the taste improves to a sweet one quickly with use. This cleaning process can be quickened by emptying the stil completely and refilling.. (best done in evening)

If your supply water leaves large amounts of sediment from evaporated salts, such as from seawater, it may be necessary to clean tl basin by hand after a few years. Remove the glass by cutting the silicone caulking with a utility knife. Insert the knife between tl bottom edge of the glass and silicone. Reattach glass with a food-grade silicone (DOW 999-A) only.Fill it each day as required, but c not drink the water from the first 3 days of operation. This will allow the still to remove any possible contaminants left over from tl construction process and from moving the still around and leveling with any contaminated water that might be inside.

Initially , there will be a slight silicone taste which disappear within a few weeks. Soon the water will taste sweet. Still operatic temperatures can exceed pastuerization temperature (170°F), depending on the time of year.

STANDARD OPERATION

If your supply water must first run through a hose, allow the water to run long enough to expel the stale water from the hose. The stale water might effect the taste of the distilled water. Fill the still either in the morning or evening. Your still will continue to work for a few hours in the evening. after the sun has set. Though you may fill the still at any time of the day, the still produces more water as the temperature of the water increases. Adding cold water to a hot still will reduce the days production. Your still will produc more water in the summer months and less in the winter. In the El Paso area, this still averages more than 3 gallons per day for the summer months, and about 1 gallon per day in the winter.

FLUSH THE STILL DAILY

When it is time to fill the still (either in the morning or evening), you should add at least twice the amount of water as was produced through the most recent production cycle. This will allow the still to flush out all salts etc. left behind from the previous production cycle (this is similar concept to what a bleed-off does in an evaporative cooler). If you do not flush the still daily, these salts will accumulate in your still, saturate, and deposit into the still growing crystals over time that can distort the still frame, possibly damage the membrane, thus shortening the useful life of the still.

If you are filling the still with contaminated water, be careful not to fill the still so that water might splash from the water inlet onto the glass cover; otherwise, you could cause a possible path for contamination of the distillate (contaminated water dripping down the glass to the collection trough). Water should be filled at a slow rate that does not cause splashing inside the still.

WATER COLLECTION

Most often a 5 gallon water jug (car-boy) is used as the collection vessel. A glass bottle is best, as there is a possibility that degradation of a plastic bottle will contaminate the water. You may wish to dig a hole deep enough for the bottle to stand up right. Another option is to shade the collection bottle to allow the water to cool sooner.

Do NOT Leave Glass Collection Bottles Full of Water Outside During Freezing Weather or they will Freeze and BREAK.

NEVER ALLOW THE STILL TO DRY OUT IN DIRECT SUNLIGHT

The membrane of the still is made from silicone, and under dry conditions the extreme temperatures cause a release of gasses which will eventually coat the underside of the glass. This coating will prevent the water from running down the glass to the collection trough properly and instead the water droplets will increase in size and fall back down into the basin. The glass will have to be removed and cleaned with a mild acid to remove this potential coating.

DO NOT EVER TRY TO OPERATE THE STILL DRY.

If the still must be left unattended, you should pinch off all water tubes, including the inlet, overflow and outlet so that water cannot escape. For longer periods, the glass should also be covered with a tarp or board to prevent sunlight from penetrating the glazing.

You can clean the outside of the glass occasionally to allow the maximum amount of sunshine into the still. A clean glass surface over a very dirty one can make as much as a 5% difference in daily water output.

Over the years the basin of the still may turn to a brownish or sandy color. This is a normal condition as the black silicone fades, but the output of the still will be gradually lessen as this condition occurs. The addition of a small amount of black stucco coloring will remedy this problem if so desired.

If The Still Must be Moved: Drain the still only in the evening when the still is not in direct sunlight. Cover the still with a piece of plywood or tarp before draining so that it is not empty in direct sunlight. You can empty the basin water by raising the still on one end, forcing the water out the overflow line. Keep the still covered until it has been reinstalled and filled with water. When the still is tilted for draining, basin water will also be allowed into the collection trough, so do not drink the water for the first 2 days of operation.

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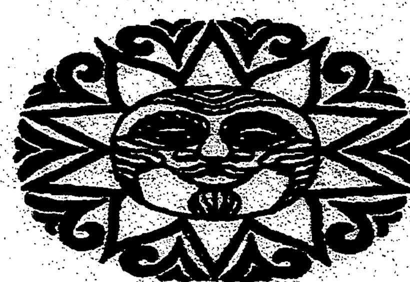

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